CLAIMS

I/We claim:

[c1] 1. A phase shifted full bridge converter having a clamp circuit, said converter comprising:

a first series switch circuit comprising a first switch and a second switch, said first switch and said second switch connected with a DC input source in series;

a second series switch circuit comprising a third switch and a fourth switch, said third switch and said fourth switch connected with said DC input source in series;

a clamp circuit comprising a first clamp diode and a second clamp diode, said first clamp diode and said clamp diode connected to said DC input source in series;

a set of inductances comprising a first inductance and a second inductance that connect in series and are coupled with each other, a terminal of said first inductance connected to a connection point at which said third switch and said fourth switch are connected in series and a terminal of said second inductance coupled to said clamp circuit;

a transformer comprising a primary winding and a secondary winding, said primary winding connected between a first connection point at which said first switch and said second switch are connected in series and a second connection point at which said first inductance and said second inductance are connected in series; and

an output rectifier circuit comprising a rectifier, a filtering capacitor, and a filtering inductance, said output rectifier circuit connected to said secondary winding;

wherein when a current in said rectifier is changing a direction of said current, a reverse recovery current of a rectifier diode of said

rectifier reflects to a primary side of said transformer and forms an induced current flowing through said first inductance and said primary winding, when said reverse recovery current of said rectifier diode is cut off, said induced current decreases and passes through said set of inductances and said clamp circuit.

[c2] 2. The converter in claim 1, said set of inductances is a tapped inductance.

[c3] 3. The converter in claim 1, said first inductance is thicker than said second inductance.

[c4] 4. The converter in claim 1, a ratio of turns of said second inductance and turns of said first inductance is small than or equal to a ratio of a leakage inductance of said transformer and said first inductance.

[c5] 5. The converter in claim 1, said first switch, said second switch, said third switch and said fourth switch are MOSFETs.

[c6] 6. The converter in claim 1, said output rectifier circuit further comprises a loss clamp circuit.

[c7] 7. The converter in claim 6, said loss clamp circuit at least comprises a resistance and a capacitor.

[c8] 8. The converter in claim 1, said set of inductances further comprises a third inductance, said third inductance connected between a connection point at which said first inductance and said second inductance are connected in series and said clamp circuit.

[c9] 9. The converter in claim 8, said first inductance is thicker than said third inductance.

[c10] 10. The converter in claim 8, a ratio of turns of said second inductance minus said first inductance and turns of said first inductance is small than or equal to a ratio of a leakage inductance of said transformer and said first inductance, and a ratio of turns of said third inductance minus said first inductance and turns of said first inductance is small than or equal to a ratio of a leakage inductance of said transformer and said first inductance.

[c11] 11. A tri-level DC/DC converter having a clamp circuit, said converter comprising:

a series capacitor comprising a first capacitor and a second capacitor, said series capacitor connected to a DC input source;

a circuit comprising a first switch ,a second switch, a third switch, and a fourth switch, said first switch, said second switch, said third switch, and said fourth switch being connected in series and connected to said DC input source;

a capacitor means connected between a connection point at which said first switch and said second switch are connected and a connection point at which said third switch and said fourth switch are connected;

a series diode comprising a first diode and a second diode, said series diode connected with said capacitor means in parallel, a connection point at which said first diode and said second diode are connected being connected with a connection point at which said first capacitor and said second capacitor are connected;

a clamp circuit comprising a first clamp diode and a second clamp diode, said clamp circuit connected with said capacitor means in parallel;

a set of inductances comprising a first inductance and a second inductance that connect in series and is coupled with each other, a terminal of

said first inductance connected to a connection point at which said second switch and said third switch are connected, and a terminal of said second inductance coupled to said clamp circuit;

a transformer comprising a primary winding and a secondary winding, said primary winding connected between a connection point at which said first diode and said second diode are connected and a connection point at which said first inductance and said second inductance are connected; and

an output rectifier circuit comprising a rectifier, a filtering capacitor, and a filtering inductance, said output rectifier circuit connected to said secondary winding;

wherein when a current in said rectifier is changing a direction of said current, a reverse recovery current of a rectifier diode of said rectifier reflects to a primary side of said transformer and forms an induced current flowing through said first inductance and said primary winding, when said reverse recovery current of said rectifier diode is cut off, said induced current decreases and passes through said set of inductances and said clamp circuit.

[c12] 12. The converter in claim 11, said set of inductances is a tapped inductance.

[c13] 13. The converter in claim 11, said first inductance is thicker than said second inductance.

[c14] 14. The converter in claim 11, a ratio of turns of said second inductance and turns of said first inductance is small than or equal to a ratio of a leakage inductance of said transformer and said first inductance.

[c15] 15. The converter in claim 11, said first switch, said second switch, said third switch and said fourth switch are MOSFETs.

[c16] 16. The converter in claim 11, said output rectifier circuit further comprises a loss clamp circuit.

[c17] 17. The converter in claim 16, said loss clamp circuit at least comprises a resistance and a capacitor.

[c18] 18. The converter in claim 11, said set of inductances further comprises a third inductance, said third inductance connected between a connection point at which said first inductance and said second inductance are connected and said clamp circuit.

[c19] 19. The converter in claim 18, said first inductance is thicker than said third inductance.

[c20] 20. The converter in claim 18, a ratio of turns of said second inductance minus said first inductance and turns of said first inductance is small than or equal to a ratio of a leakage inductance of said transformer and said first inductance, and a ratio of turns of said third inductance minus said first inductance and turns of said first inductance is small than or equal to a ratio of a leakage inductance of said transformer and said first inductance.